

BAYOU COURTABLEAU TMDL FOR SULFATE
SUBSEGMENT 060204

US EPA Region 6

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody. A TMDL has been developed for Bayou Courtableau. Sulfate is monitored as the indicator for the protection of fish and wildlife propagation use designation.

There are two flow regimes in Bayou Courtableau which make it two separate bayous rather than one. The source of the water for the eastern section of the bayou is the Atchafalaya River. This section flows into Bayou Teche. The western section of the bayou also flows into Bayou Teche and its source of water is the Bayou Cocodrie/Boeuf system. Bayou Courtableau subsegment 060204 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for propagation of fish and wildlife. Louisiana's water quality standards for chloride, sulfate, and TDS is applied as follows:

“Numerical criteria for these parameters generally represent the arithmetic mean of existing data from the nearest sampling location plus three standard deviations. For estuarine and coastal marine waters subsegments in Table 3 that have no listed criteria (i.e., designated N/A), criteria will be established on a case-by-case basis using field determination of ambient conditions and the designated uses. For water bodies not specifically listed in the Numerical Criteria and Designated Table, increases over background levels of chloride, sulfate, and TDS may be permitted. Such increases will be permitted at the discretion of the office on a case-by-case basis and shall not cause in-stream concentrations to exceed 250, 259, and 500 mg/l for chloride, sulfate, and TDS, respectively, except where a use attainability analysis indicates that higher levels will not affect the designated uses. In permitting such increases, the office shall consider their potential effects on resident biota and downstream water bodies in addition to the background conditions. Under no circumstances shall an allowed increase over background conditions cause any numerical criteria to be exceeded in any listed water body or any other general or numerical criteria to be exceeded in either listed or unlisted water bodies.”

Seven months (June, 1998 – December 1998) of monthly LDEQ monitoring data on Bayou Courtableau were assessed to determine if the propagation of fish and wildlife use was being maintained. Analysis of the data shows that the propagation of fish and wildlife use is not protected (see Appendix A). Therefore, a TMDL has been developed for sulfate.

For the purpose of calculating current loading on Bayou Courtableau the average sulfate concentration was calculated using monthly LDEQ monitoring data on Bayou Courtableau. In Bayou Courtableau, the monthly sulfate concentrations range from 4.5 mg/l to 55.7 mg/l over the collection period (June, 1998 – December, 1998).

For the purpose of TMDL development, the criterion of 30 mg/l was applied. The sulfate TMDL was developed based on simple dilution calculations using average flow and the state sulfate criterion of 30 mg/l. The TMDL calculation includes a wasteload allocation, a load allocation, and a margin of safety. A 13% reduction in sulfate loading will be needed to meet the standard for the propagation of fish and wildlife.

1. Introduction

Bayou Courtableau segment 060204 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for propagation of fish and wildlife. On the 1998 List, this segment was ranked as a high priority (1) for TMDL development. A TMDL for sulfate was developed in accordance with the requirements of Section 303 of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. The TMDL consists of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources of the pollutant of concern, and the load allocation is the load allocated to nonpoint sources. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions and data inadequacies.

2. Study Area Description

2.1 General Information

Water quality segment 060204 is part of the Vermilion-Teche River Basin. The Basin encompasses the prairie region of the state and a section of the coastal zone. Bayou Courtableau is located in southwestern Louisiana in the Vermilion-Teche River Basin. The Vermilion-Teche River Basin is bounded on the north by the Red River Basin, on the east by the Atchafalaya Basin, on the west by the Mermentau River Basin and southward by the Gulf of Mexico. Land use in the Vermilion-Teche Basin is largely agriculture, the primary crops being corn, soybeans, and milo. The average annual rainfall in the vicinity of Bayou Courtableau is approximately 57 inches. The land use for Bayou Courtableau watershed is summarized in Table 1.

Table 1. Land Uses in Segment 060204

LAND USE TYPE	NUMBER OF ACRES	% OF TOTAL AREA
Urban	125	0.1
Agricultural	76,742	63.8
Forest Land	221	0.2
Water	4,775	4.0
Wetland	38,319	31.8
Rangeland	163	0.1
TOTAL AREA	120,345	100

The area is sparsely populated outside its small municipalities and land use is dominated by agriculture.

2.2 Water Quality Standards

The designated uses for Bayou Courtableau include primary contact recreation, secondary contact recreation, and propagation of fish and wildlife. Sulfate serves as the indicator used for the water quality criteria and for assessment of use support. Louisiana's water quality criterion for sulfate in subsegment 060204 is 30 mg/l.

2.3 Identification of Sources

Sources suspected of affecting the water quality of Bayou Courtableau include municipal sources, agriculture, irrigated crop production, and other unknown sources (LDEQ, 1993).

2.3.1 Point Sources

Several minor point sources fall within the subsegment. Many of these facilities are either intermittent stormwater or minor discharges. Five facilities are known to discharge sanitary wastewater into the Bayou Courtableau subsegment. The combined flow of all these discharges is 72,425 gallons per day (see Table 2).

Table 2. Dischargers in Subsegment 060204

Dischargers to Bayou Courtableau			
Facility	Permit #	Design Flow (MGD)	Wasteload Allocation (lb/day)*
Washington Campground	LAG530762	0.025	6.26
Tri-Community Nursing Center/Peace Inc.	LAG540553	0.0108	2.7
Palmetto Elderly Apartments	LAG540556	0.025	6.26
Morrow Housing Project	LAG540685	0.0075	1.88
Washington Elementary School	LAG540896	0.004125	1.03
Totals:		0.072425	18.13

* loads calculated using 30mg/l criterion and design flow.

2.3.2 Nonpoint Sources

The predominant land uses in the Bayou Courtableau watershed are agriculture and forestry. It is unknown to what extent each of these land uses contributes to sulfate loads through runoff. There are also numerous rural residences where other domesticated animals may be found. These rural residences may also contribute to the sulfate load if they have septic tanks or septic fields for their wastewater treatment.

3. TMDL Load Calculations

3.1 Current Load Evaluation

Sulfate loads have been calculated using the instream sulfate concentration and the flow of the stream. The following equation can be used to calculate sulfate loads.

$$\text{Equation 1. } C \times Q \text{ in cfs} \times 5.39 \text{ lb/day or } C \times Q \text{ in MGD} \times 8.34 \text{ lb/day}$$

Where: C = concentration in mg/l

Q = stream flow in cfs or MGD

A traditional expression of the loading may be developed by setting one critical or representative flow and concentration, and calculating the sulfate load using Equation 1. The difficulty with this approach is in the determination of the appropriate flow or concentration value to use.

For the purpose of calculating current loading on this waterbody the average sulfate concentration was calculated using monthly LDEQ monitoring data on Bayou Courtableau. In Bayou Courtableau, the monthly sulfate concentrations ranged from 4.5 mg/l to 55.7 mg/l over the collection period (June, 1998 -December, 1998). The average sulfate concentration is 34.5 mg/l (see Appendix A). In addition, the average flow for Bayou Courtableau is 520 ft³/sec (see Appendix B). Using these values and Equation 1 it is estimated that the current loading is 96,697 lb/day.

3.2 TMDL

Point sources usually have a defined critical receiving stream low flow such as the 7Q10 (or Harmonic mean flow) at which the criterion must be met. For nonpoint sources it is recognized that there may be no single critical flow condition. The load reduction needed to meet the water quality standard for propagation of fish and wildlife in Bayou Courtableau at 520 cfs is 12,613 lb/day (13.0% reduction). This was obtained by calculating the allowable TMDL at 520 cfs for the 30 mg/l criterion (84,084 lb/day) and subtracting this load from the observed load (96,697 lb/day).

$$\text{Current Load - TMDL} = \text{Load Reduction}$$

$$96,697 \text{ lb/day} - 84,084 \text{ lb/day} = 12,613 \text{ lb/day}$$

3.3 Wasteload Allocation (WLA)

The Louisiana Water Quality Regulations require permitted point source discharges of treated sanitary wastewater to maintain an in-stream sulfate concentration of 30 mg/l (Subsegment 060204).

Equation 1 can be used to calculate the total point source load (wasteload allocation) utilizing the water quality criterion for sulfate of 30mg/l and the design flow of all the wastewater dischargers (0.072425 million gallons/day) (Table 2).

$$\text{Cstd mg/l} \times \text{Q in MGD} \times 8.34 = \text{WLA lb/day}$$

Where, Cstd is the water quality standard and Q is the discharge design flow from permitted facilities in subsegment 060204 thus:

$$\text{WLA for sulfate} = 30 \text{ mg/l} \times 0.072425 \text{ MGD} \times 8.34 = 18.13 \text{ lb/day}$$

See Table 2 for individual discharger wasteload allocations.

3.4 Load Allocation (LA)

The load allocation at a given flow can be calculated using Equation 1 and the following relationship:

$$(\text{TMDL@ given flow and criterion}) - (\text{WLA}) = \text{LA}$$

$$\text{LA for instream flow of 520 cfs} = 84,066 \text{ lb/day}$$

$$84,084 \text{ lb/day (TMDL@ 520 cfs)} - 18.13 \text{ lb/day (WLA)} = 84,066 \text{ lb/day}$$

3.5 Seasonal Variability

Louisiana's water quality standard for sulfate is for January through December. Therefore, no seasonal TMDL for sulfate was developed.

3.6 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration a margin of safety. EPA guidance allows for the use of implicit or explicit expressions of the margin of safety or both. When conservative assumptions are used in the development of the TMDL or conservative factors are used in the calculations, the margin of safety is implicit. When a percentage of the load is factored into the TMDL calculation as a margin of safety, the margin of safety is explicit. In this TMDL for fecal coliform, conservative assumptions have been used and therefore, the margin of safety is implicit. These conservative assumptions are:

- Using average flows to calculate current loading to obtain load reduction.
- Treating sulfate as a conservative pollutant, that is, a pollutant that does not degrade in the environment.
- Using the design flow of the point source dischargers rather than actual average flow rates, which are typically much lower (as applicable).

4. Other Relevant Information

Although not required by this TMDL, LDEQ utilizes funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act to operate an established program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been established by the time the first priority basins are monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following establishment of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Vermilion-Teche River Basin will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
1999 - Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

REFERENCES

LDEQ Ambient Water Quality Database (<http://www.deq.state.la.us/surveillance/wqdata/0665wqng.txt>)

LDEQ, 1993. State of Louisiana Water Quality Management Plan, Volume 6, Part A: Nonpoint Source Pollution Assessment Report. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, LA.

LDEQ, 1998. *State of Louisiana Water Quality Management Plan, Volume 5, Part B: Water Quality Inventory*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, LA.

APPENDIX A. Sulfate Data

Bayou Courtableau in Port Barre, Louisiana

DATE	TIME	SULFATE (mg/l)
12/9/98	1030	11.0
11/24/98	1025	4.5
11/10/98	0750	39.9
10/28/98	1145	38.9
10/14/98	1037	55.7
9/23/98	1115	8.5
9/9/98	1051	49.6
8/26/98	1110	41.6
8/12/98	1140	43.0
7/29/98	1058	33.8
7/15/98	0900	42.3
6/24/98	1107	44.7

n = 12

Sulfate criterion = 30 mg/l

Exceedance rate = $9/12 = 75\%$

Average concentration = 34.5 mg/l

(Reference: <http://www.deq.state.la.us/surveillance/wqdata/0665wqng.txt>)

APPENDIX B. Flow Information

Flow in the eastern section of Bayou Courtableau is largely governed by the volume of water pumped from the Atchafalaya River via the Teche-Vermilion Pumping Station in Krotz Springs, Louisiana. According to Ralph Castille, Operations Supervisor of the Teche-Vermilion Pumping Station, the volume of water pumped through the station varies according to downstream water levels in Bayous Courtableau and Teche. Based on information provided by LDEQ, the pumping station presently operates 5 pumps with a maximum pumping capacity of 260 cfs per pump. Between one and four pumps can be operated at any given time, although the actual number in operation varies over time. No pumps are operated during very high flow events. Annual average flow through the pumps is presently unknown. Given the lack of recent ambient flow data on the stretch of Bayou Courtableau between Krotz Springs and Port Barre, we must estimate the average annual flow as a value between 0 cfs (no pumps in operation) and 1040 cfs (4 pumps being operated at full capacity). Taking the average of the minimum and maximum possible values for flow, we estimate flow in this stretch of Bayou Courtableau to be 520 cfs.